Attendance Problems. Find the distance between each pair of points. If necessary, round your answer to the nearest hundredth.

1. (6, 2) & (-3, -2) **2.** (4, 5) & (0, 2) **3.** (8, 1) & (3, 6)

4. Fill in the table of values for the equation $y = x - 14$.

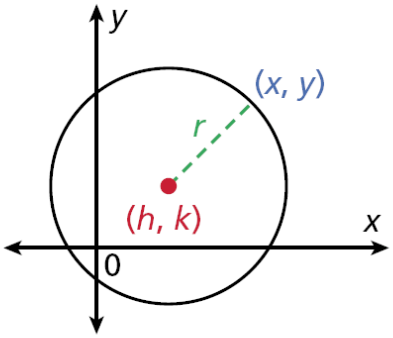
x	-1	0	1	2
y				

- I can write equations and graph circles in the coordinate plane.
- I can use the equation and graph of a circle to solve problems.

Common Core: CC.9-12.G.GPE.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

"Worry is interest on money never borrowed."—*Unknown*

The equation of a circle is based on the Distance Formula and the fact that all points on a circle are equidistant from the center.



$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$ *Distance Formula*

$$r = \sqrt{(x - h)^2 + (y - k)^2}$$ *Substitute the given values.*

$$r^2 = (x - h)^2 + (y - k)^2$$ *Square both sides.*

Theorem 11-7-1 **Equation of a Circle**

The equation of a circle with center (h, k) and radius r is $(x - h)^2 + (y - k)^2 = r^2$.

1 Writing the Equation of a Circle

Write the equation of each circle.

A $\odot A$ **with center** $A(4, -2)$ **and radius 3**

$(x-h)^2+(y-k)^2=r^2$ *Equation of a circle*

$(x-4)^2+(y-(-2))^2=3^2$ *Substitute 4 for h, −2 for k, and 3 for r.*

$(x-4)^2+(y+2)^2=9$ *Simplify.*

B $\odot B$ **that passes through** $(-2, 6)$ **and has center** $B(-6, 3)$

$r=\sqrt{(-2-(-6))^2+(6-3)^2}$ *Distance Formula*

$=\sqrt{25}=5$ *Simplify.*

$(x-(-6))^2+(y-3)^2=5^2$ *Substitute −6 for h, 3 for k, and 5 for r.*

$(x+6)^2+(y-3)^2=25$ *Simplify.*

Example 1. Write the equation of each circle.

A. $\bigcirc J$ with center J(2, 2) and radius 4.

B. $\odot K$ that passes through J(6, 4) & has center K(1, - 8)

Guided Practice. Write the equation of each circle.

4. $\odot P$ with center P(0, -3) and radius 8.

5. $\odot Q$ that passes through (2, 3) and has center $Q(2, -1)$.

If you are given the equation of a circle, you can graph the circle by making a table or by identifying its center and radius.

2 Graphing a Circle

Graph each equation.

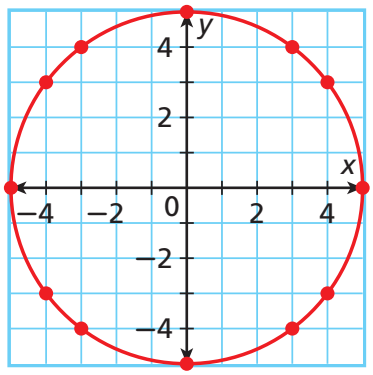
A $x^2 + y^2 = 25$

Step 1 Make a table of values.

Since the radius is $\sqrt{25}$, or 5, use ± 5 and the values between for x-values.

x	-5	-4	-3	0	3	4	5
y	0	± 3	± 4	± 5	± 4	± 3	0

Step 2 Plot the points and connect them to form a circle.

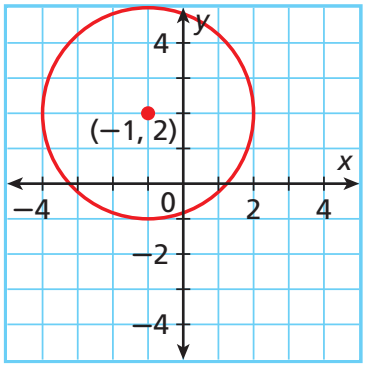


B $(x+1)^2 + (y-2)^2 = 9$

The equation of the given circle can be written as $(x-(-1))^2 + (y-2)^2 = 3^2$.

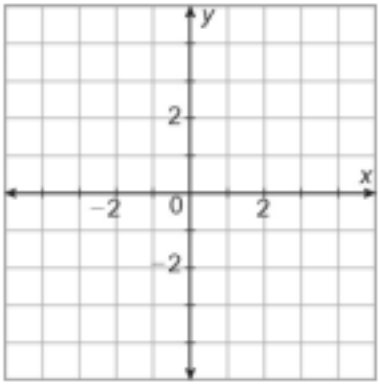
So $h = -1$, $k = 2$, and $r = 3$.

The center is $(-1, 2)$, and the radius is 3. Plot the point $(-1, 2)$. Then graph a circle having this center and radius 3.

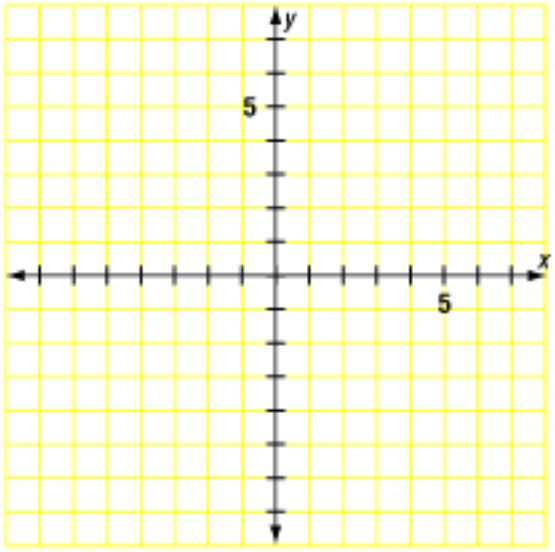


Example 2. Graph the following

A. $x^2 + y^2 = 16$

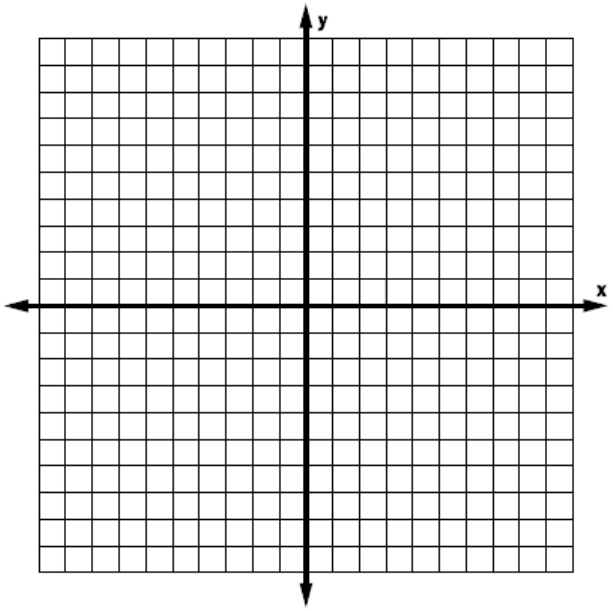


B. $(x-3)^2 + (y+4)^2 = 9$



6. Guided Practice. Graph

$(x-3)^2 + (y+2)^2 = 4$



3 *Meteorology Application*

Meteorologists are planning the location of a new weather station to cover Osceola, Waco, and Ireland, Texas. To optimize radar coverage, the station must be equidistant from the three cities which are located on a coordinate plane at $A(2, 5)$, $B(3, -2)$, and $C(-5, -2)$.

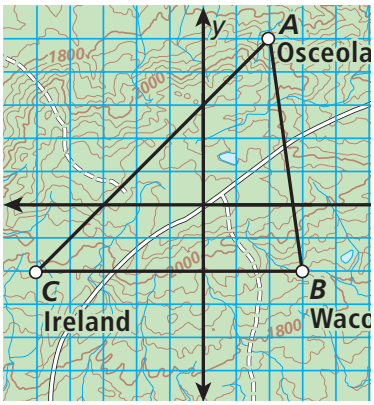
a. What are the coordinates where the station should be built?

b. If each unit of the coordinate plane represents 8.5 miles, what is the diameter of the region covered by the radar?

Step 1 Plot the three given points.

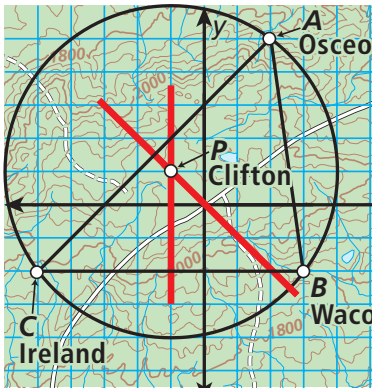
Step 2 Connect A, B, and C to form a triangle.

Step 3 Find a point that is equidistant from the three points by constructing the perpendicular bisectors of two of the sides of $\triangle ABC$.



The perpendicular bisectors of the sides of $\triangle ABC$ intersect at a point that is equidistant from A, B, and C.

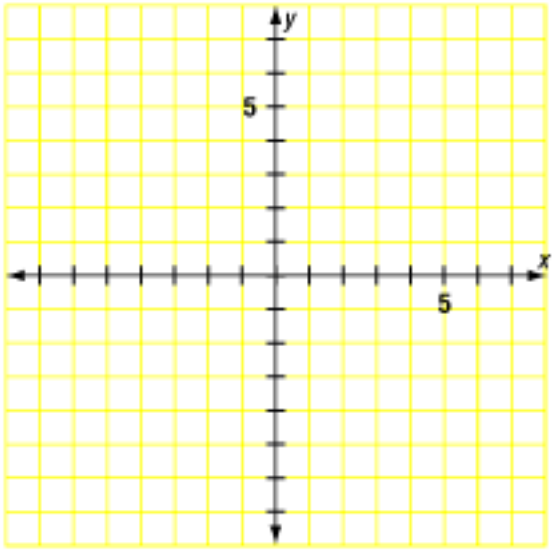
The intersection of the perpendicular bisectors is $P(-1, 1)$. P is the center of the circle that passes through A, B, and C.



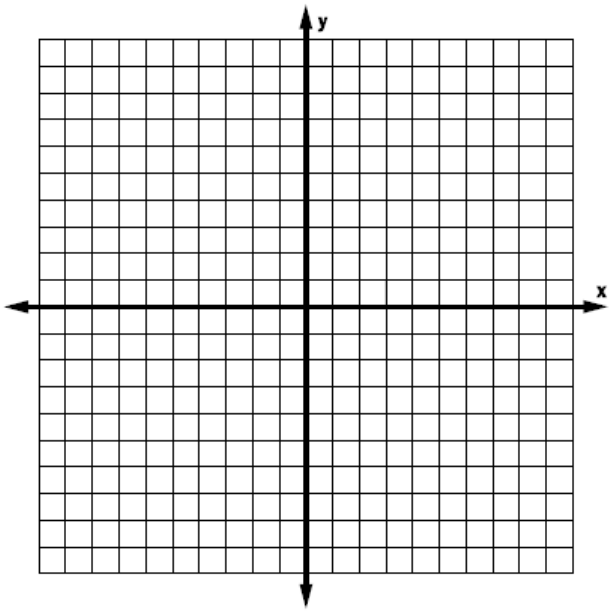
The weather station should be built at $P(-1, 1)$, Clifton, Texas.

There are approximately 10 units across the circle. So the diameter of the region covered by the radar is approximately 85 miles.

Example 3: An amateur radio operator wants to build a radio antenna near his home without using his house as a bracing point. He uses three poles to brace the antenna. The poles are to be inserted in the ground at three points equidistant from the antenna located at $J(4, 4)$, $K(-3, -1)$, and $L(2, -8)$. What are the coordinates of the base of the antenna?



7. Guided Practice. Suppose the coordinates of the three cities in Example 3 (p. 801) are $D(6, 2)$, $E(5, -5)$, and $F(-2, -4)$. What would be the location of the weather station?



12-7 Circles in the Coordinate Plane

- Mickey Mouse Graph in Desmos
- *(p 850)* 18, 24, 28, 29, 34, 36, 38, 41.
- 12B Ready to Go On pretest & posttests.